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SPINAL CORD INJURY: WHAT EVERY REHABILITATION COUNSELOR SHOULD
KNOW ABOUT FUNCTION AND INDEPENDENCE

By

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B.S., Western Illinois University, 2007

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the

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Master of Science

in the field of Rehabilitation Counseling

Approved by:

Dr. Thomas D. Upton

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AN ABSTRACT OF THE RESEARCH PAPER OF

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TITLE: SPINAL CORD INJURY: WHAT EVERY REHABILITATION COUNSELOR SHOULD KNOW ABOUT FUNCTION AND INDEPENDENCE

MAJOR PROFESSOR: Dr. Thomas D. Upton

For those individuals who sustain an acute spinal cord injury (SCI), the focus of life often becomes the disability and loss: loss of function and independence, loss of friends and even family, and loss of work and leisure activities. This focus often leads to isolation and non-compliance with self-care. With non-compliance, the quality of life can quickly deteriorate exacerbating numerous underlying health risks associated with SCI. Compliance with each individual's personal treatment plan is the critical element for the attainment and maintenance of functional independence and successful rehabilitation outcomes.

This paper reviews literature related to SCI, the progression of treatment and current life expectancy, and the devastating effects of having a SCI. Three areas will be addressed. Chapter one discusses SCI focusing on the progression of treatment, incidence, prevalence, and costs of sustaining a SCI. Chapter two presents literature review of current trends in SCI rehabilitation and a review of the secondary complications of SCI as well as mental health issues related to SCI and overall life satisfaction. Chapter three provides a discussion and recommendations for future research. For purposes of this paper, statistical information and all reference to SCI is for acute onset only; this excludes, for example, birth anomalies such as spina bifida.

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CHAPTER 1

INTRODUCTION

This study is about attaining and maintaining functional independence in people with acute traumatic spinal cord injury (SCI). First, to define a SCI, the spinal cord is a thick whitish bundle of nerve fibers encased within the length of the spinal column extending from the bottom of the brain to the second lumbar vertebrae (Sheerin, 2004). These nerve fibers carry sensory and motor impulses to and from the brain (Sheerin, 2004; Tewarie, Hurtado, Bartels, Grotenhuis, & Oudega, 2010). When trauma such as illness (e.g., spinal stroke) or injury (e.g., automobile accident) interrupts these impulses, loss of movement (e.g., paralysis) and loss of sensation can occur (Sheerin, 2004; Tewarie et al., 2010; Wu & Chan, 2007). This is otherwise known as a spinal cord injury (SCI).

Second, there are two classifications of SCI: Tetraplegia (e.g., formerly known as Quadriplegia) and Paraplegia. Tetraplegia is paralysis involving the cervical region (e.g., the neck) of the spinal cord and paraplegia is paralysis involving the thoracic region (e.g., the chest) of the spinal cord or lower (Eltorai, 2004; Tate, Forchheimer, Krause, Meade, & Bombardier, 2004). Paralysis in general can be defined as illness or injury to one or more bones of the spinal column causing damage to the spinal cord which results in loss of movement, loss of sensation, or loss of both, below the level of injury. This loss of function can affect arms, legs, and trunk (Eltorai, 2004; Tate et al., 2004) as well as normal function of internal organs such as the lungs, the kidneys, the bladder and the bowels (Cohen & Schemm, 2007; Sheerin, 2004). These internal systems will be discussed further in the next chapter.

Background

The population of those with SCI in the United States increases by approximately 12,000 each year (NSCISC, 2011) which translates to one new SCI every 43.8 minutes. Documented as far back in history as 3500 B.C. in numerous ancient Egyptian hieroglyphs (Filler, 2007), sustaining a SCI was an automatic death sentence. For example, there is a document called the Edwin Smith Papyrus which was written by an Egyptian physician at approximately 3000 B.C. The Papyrus (Eltorai, 2004; Naderi et al., 2004) contains 48 medical cases, six of which specifically address SCI and accurately describes the symptoms of cervical SCI which in part states:

...unconscious of his two arms and two legs...urine drips from his member without his knowing it...his two eyes are bloodshot; it is a dislocation of a vertebra of his neck extending to his backbone, which causes him to be unconscious [of these things]...it is an ailment not to be treated [cured] (Eltorai, 2004, p. 330).

For those cases surviving the initial onset of injury, preventing decubiti (e.g., life-threatening open wounds which result from lack of blood flow due to inactivity) was futile. Due to inactivity after acquiring a SCI, skin integrity is compromised within hours leading to decubiti, infection, and death. Once the skin has been compromised and these ulcers open, tissue quickly deteriorates progressing through muscle and bone (Young, 1997; NSCISC, 2011). Treatments for pressure ulcers during those times included: “leaving ulcers dry and exposed to the air; applying a poultice of juice, honey, vinegar, oil, lead, lotus, and other topical applications; and, wound irrigation using clean water or boiled river water” (Eltorai, 2004, p. 335). These treatments would not have prevented infection. In addition, there is nothing found in the literature in the way of pain management. It is presumable then that those who survived the

initial onset of the SCI would have suffered a great deal of agony from these secondary complications before succumbing to death (Davies, 1994; Gould et al., 2000; NSCISC, 2011).

During the mid-20th century life expectancy slowly began to increase due to huge advancements in the medical field including surgery, pharmacology, and rehabilitation. With the advent and progression of technology, came state-of-the-art diagnostic equipment, knowledge of the intricate inner anatomy of the spinal cord as well as the corresponding function along each vertebra (Eltorai, 2004). Due to the advancements in technology as well as significantly better treatment options for the secondary illnesses and complications associated with having a SCI, the gap in life expectancy between people with SCI and their nondisabled counterparts is quickly closing.

Today, a person acquiring a low level cervical SCI (e.g., C5-C8) at the age of 20 can expect to live another 40 years; a person injured at the age of 32 can expect to live another 32 years; and, at the age of 40, another 24 years (NSCISC, 2011, Wyndaele & Windaele, 2006). The current gap between the lifespan of those with a SCI and that of their average nondisabled counterparts is about 15 to 20 years. According to the National Center for Health Statistics (2011), the average life expectancy for the nondisabled community in 2009 was 78.5 years. Data for 2010 is in the preliminary stages and beyond that is unavailable (NCHS, 2011).

Etiology for traumatic SCI in the United States consists of automobile accidents, falls, acts of violence such as gunshots and stabbing related incidents, sports activities such as football related incidents, leisure activities such as diving accidents, and sometimes health related incidents such as a spinal stroke (Cripps et al., 2011; De Vivo & Chen, 2011; NSCISC, 2011; Tewarie et al., 2010; Wu & Chan, 2007). McDonald and Sadowsky (2002) reported incidence rates of SCI to be between 28 and 55 per million with an overall population of 183,000 to

230,000 people in the United States with a SCI. Recently, however, Tewarie et al. (2010) estimated the total population of people with SCI in the United States to be between 227,080 and 300,938. With life expectancy for this population on the rise, people with SCI must prepare for their future in regards to their day to day care, appropriate medical care, and proper housing. The needs of this population will escalate as they age and without proper planning, support will likely fall to family members (Kemp et al., 2004).

Significance of Study

In the United States, SCI is listed as the second most expensive medical condition (Tewarie et al., 2010) ranked after infantile respiratory distress syndrome. McDonald and Sadowsky (2002) reported lifetime costs per person to be between \$500,000 and \$2 million dollars. They also reported that total costs related to SCI care in the United States at that time exceeded \$7 billion dollars per year. Currently however, according to the NSCISC (2011), a low level cervical SCI (e.g., C5-C8) will cost approximately \$712,308 the first year regardless of age at onset of injury and \$105,013 each subsequent year. At 25 years of age at the onset of injury, the estimated lifetime cost per person with a C5-C8 level SCI is \$3,195,853 (NSCISC, 2011). The yearly costs relating to the overall medical management of SCI is estimated to be between \$10 billion dollars (Tewarie et al., 2010) and 14.5 billion dollars (Ploumis et al., 2011). It is this author's opinion that the increase in costs per person is directly related to the longer lifespan of those with SCI which has resulted from technological advancements and better treatment options.

The increase in longevity of life and rising costs associated with living with a SCI is extremely important information to be aware of for the Rehabilitation Counseling professional. With the enactment of the Americans with Disabilities Act of 1990, this ever-growing population

has seen tremendous gains in opportunities for community integration post-hospitalization. Rehabilitation counselors can expect to provide services to this population and will need to determine appropriate services in order to capitalize each individual's maximum potential particularly in the area of employability. Sustaining a SCI no longer means exclusion from mainstream society nor does it mean exclusion from earning a competitive wage and being a productive member of society.

Armed with this information, a knowledgeable rehabilitation counselor can be instrumental in assisting with the improvement of the quality of life for this population by providing better comprehensive rehabilitation services in correlation with the individual's functional capabilities. The rehabilitation counselor will need to have a basic understanding of what it means to be functionally independent for this population, the process it took to get there, and how to maintain it (Kemp, Adkins, & Thompson, 2004).

Purpose and Objectives

The purpose of this study is to impart valuable information in the attainment and maintenance of functional independence to the rehabilitation counseling professional in order to promote the use of evidence-based practice while providing evidence-based services to people with SCI. This will be accomplished first by identifying current trends in SCI rehabilitation practices. In order for the rehabilitation counselor to understand functional independence as it relates to people with SCI, they must know the steps taken or the process involved in achieving any level of functional independence. This will aid in understanding the importance of maintaining functional independence once achieved.

Second, the secondary illnesses and complications associated with SCI will be identified and reviewed. The overall health of individuals with SCI will contribute to the longevity of life

and maintenance of functional independence. Likewise, neglecting one's health and noncompliance with one's individual treatment plan will exacerbate the secondary complications associated with SCI.

Finally, life satisfaction of those who sustain a SCI will be analyzed. One's general life satisfaction after acquiring a SCI is another contributing factor to one's overall health. It may also contribute to whether the individual is an active participant in social activities as well.

Summary

Several aspects associated with SCI were reviewed including the definition, the progression of treatment, prevalence and incidence, and healthcare costs. Although the progression of spinal cord stabilization and the treatment of secondary illnesses and complications of SCI have been extremely slow, recent trends are quite promising. With the arrival of the twentieth century, advancements in technology led to greater knowledge in the structure and function of the human anatomy, namely the spinal cord, leading ultimately to better treatment options for people with SCI with longevity of life growing ever closer to the life expectancy of the non-disabled community. While life expectancy of those who have sustained a SCI has greatly increased and while surgical treatments of the SCI have vastly improved, it is the treatment and management of the ensuing secondary illnesses and health complications which has significantly increased the life expectancy of those with a SCI.

This increase in life expectancy makes it necessary for this population to focus on long-term goals and community integration. Therefore, the purpose of this study is to impart valuable information in the attainment and maintenance of functional independence to the rehabilitation counseling professional in order to promote the use of evidence-based practice while providing evidence-based services to people with SCI.

The next chapter will examine the literature for current trends in acute SCI rehabilitation as well as the secondary illnesses and complications which must be prevented or overcome in order for individuals with SCI to reach and maintain any level of functional independence. An extensive analysis will be provided. A final chapter will provide discussion and implications as well as future research suggestions.

Definition of Terms

Cervical vertebrae: The eight bones of the neck region.

Counter-traction: Opposing forces of traction used in the reduction of fractures.

Decubiti: Sores which develop as a result of lack of blood flow to any particular area of the body due to non-movement.

Edwin Smith Papyrus: A collection of 48 different medical cases dating back to 3000 B.C.

Paralysis: Loss of feeling, loss of movement, or loss of both from the point of injury or accident to the spinal cord and below.

Paraplegia: Permanent inability to move both legs and usually the lower part of the trunk, often as a result of disease or injury of the spinal cord.

Pressure ulcers: See decubiti.

Quadriplegia: Common term referring to paralysis from the neck down (see tetraplegia).

Sarcophagi: An ancient stone or marble coffin, often decorated with sculptures and inscriptions.

Spina Bifida: A congenital birth defect in which the spinal cord does not fully develop and is often partially exposed.

Spinal Cord: A thick whitish cord of nerve tissue extending from the bottom of the brain through the spinal column and giving rise to pairs of spinal nerves that supply the body.

The spinal cord and brain together form the central nervous system.

Tetraplegia: Formal term referring to the permanent inability to move all four limbs or the entire body below the neck due to an injury/lesion or illness of the spinal cord in the cervical region.

Therabands: Stretchable colored bands where each color represents a different weight of resistance. For example: white = 1 pound; yellow = 3 pounds; green = 5 pounds, etc.

Traction: A gentle pulling force to treat muscle and skeletal disorders.

CHAPTER 2

LITERATURE REVIEW

Although SCI can be traced back to ancient times, successful treatments resulting in increased life expectancies, which are growing ever closer to matching that of the non-disabled community, have developed only over the past 60 to 70 years. With near-normal life expectancies, people with SCI have increasing opportunities for self-preservation and community integration and it begins with acute SCI rehabilitation. This chapter will discuss current SCI rehabilitation practices in order for the rehabilitation counselor to learn the process of attaining functional independence. This will be followed by a review of secondary illnesses and complications of SCI in order for the rehabilitation counselor to understand barriers in maintaining long-term health as well as any functional independence. To complete this chapter, outcomes and life satisfaction will be analyzed.

Current Rehabilitation Practices

Following hospitalization for spinal stabilization is placement in a rehabilitation facility for acute inpatient SCI rehabilitation (Zanca et al., 2011). The average stay is approximately 8 weeks but can be longer if patient continues to show improvements (Cohen & Schem, 2007; Magee Rehab, 2010; Rehabilitation Institute of Chicago [RIC], 2012). Although each institution practices their own methods, their end goal is universal: for each individual to leave the facility functioning as independently as possible given the level and severity of their injury; for each individual to be educated enough to have a basic understanding of their injury and how it may affect them; and, to have knowledge of available resources in their community as well as in their state (Magee Rehab, 2010; RIC, 2012).

Determination of Neurological Deficits

With approximately 650 muscles in the human body (Sirgan, 2007), diagnosing neurologic deficits as soon as possible after a SCI is crucial. This is accomplished using the American Spinal Injury Association (ASIA) Impairment Scale. This instrument is the standard of measure in determining neurologic impairment after SCI and whether the injury is complete or incomplete. It consists of five ranges: “A) complete with no sensory or motor function below level of injury; B) incomplete with sensory but no motor function below level of injury; C) incomplete with motor function below the level of injury [key muscles have a grade <3]; D) incomplete with motor function below level of injury [key muscles have a grade >3]; and E) normal motor and sensory function” (McDonald & Sadowsky, 2002, p. 809). The specific range of deficits is determined using the ASIA sacral sparing measurements which consist of “S4-5 dermal light touch (LT), S4–5 pin prick (PP), anal sensation, and voluntary anal contraction” (van Middendorp, Hosman, Pouw, EM-SCI Study Group, & Van de Meent; 2009). The SCI is said to be complete if all four measurements are absent; it is considered incomplete if one or more of the four measurements is present. Another dimension of the sacral sparing measurements, based on initial neurological assessment, is predicting neurological recovery. Van Middendorp et al. (2009) conducted a longitudinal study whereby the objective was to validate the predictive value of the ASIA impairment scale sacral sparing measurements in terms of independent ambulation after one year. Results showed that although the four sacral sparing measurements are valid and reliable in determining neurologic deficits, they are not reliable in predicting ambulatory recovery.

A person with a low level cervical SCI would have extremely limited musculature function making independence difficult, but not entirely impossible. This functional

independence would, however, only apply to individuals with injuries at level C6 and below. Persons with C6 level injury would have control of the facial, head/neck, and other upper extremity muscles, excluding fine motor manipulation (Sirgan, 2007). In other words, a person with low cervical Tetraplegia (e.g., C6 through C8) has complete or partial muscle control from about the upper-chest level and higher only. Individuals with a level C4/C5 injury and higher would be dependent on a respirator and need at a minimum partial nursing care. In light of this information, it is important to study rehabilitation in the SCI population in order to understand the process of attaining functional independence, how it is maintained, and how it can affect future participation in various activities such as gainful employment.

Rehabilitation

Two articles were found in the literature regarding the specific combined contents of SCI rehabilitation. The focus was two-fold. First, in the former article, was the identification of early interventions used to improve self-care and mobility for those with SCI. Those interventions are physical therapy (PT), occupational therapy (OT), and recreational therapy (RT). Van Langeveld et al. (2011) posit there was insufficient evidence-based literature regarding the effectiveness and uniformity of SCI rehabilitation interventions. As such, they created the Spinal Cord Injury-Interventions Classification System (SCI-ICS) to compare the interventions implemented among three Dutch SCI rehabilitation institutes all within the same system of healthcare. By using the SCI-ICS to record treatment content, methods, and time among the three facilities, they identified differences and similarities in the implementation of SCI rehabilitation indicating continuity of care across various settings. Although this study was done outside of the United States, van Langeveld et al. (2011) indicated that the SCI-ICS was developed using international literature. In the latter article, van Langeveld et al. (2011)

performed a consecutive international study among Australia, Norway, and the Netherlands using the SCI-ICS obtaining similar results. Both studies revealed the primary focus of SCI rehabilitation interventions is strength-based and mobility-based while the least amount of attention is placed on toileting issues and eating and drinking.

physical therapy. Participating in PT is a major component in the attainment of functional independence. PT focuses on compensatory techniques in performing daily activities (Sadowsky & McDonald, 2009) and is concentrated in the areas of flexibility and coordination, strength and endurance, balance and core stability, wheelchair management/propulsion, and all forms of transfers (Magee Rehab, 2010; RIC, 2012; Zanca et al., 2011).

mobility. For people who have acquired a SCI, wheelchair selection becomes a critical issue in mobility and performing activities of daily living (ADL's) and will have a huge impact on independence, life satisfaction, community integration, and even employment. In a study conducted by Hastings, Robins, Griffiths, and Hamilton (2011), it was noted that having the proper wheelchair for your size, functional abilities, and geographical demographics, can positively or negatively influence a person's functional independence and overall life satisfaction and participation. For example, putting a person with C5 Tetraplegia, who would have extremely limited upper extremity range of motion and strength, in a manual wheelchair would ultimately prove to be detrimental in that they would not have the ability to propel themselves. Likewise, they would not be able to participate in life activities without some sort of mobility intervention (e.g., an assistant to push their wheelchair). Realistically, their mobility needs would be better served with a power chair (e.g., battery operated motorized wheelchair). Hastings et al. (2011) posit that for people with C6 tetraplegia and lower, there are added benefits to using the appropriate manual wheelchair which include higher fitness levels, higher

degrees of independence, higher self-esteem, and greater involvement in social and community activities.

occupational therapy. The major focal point of OT is the management of personal care activities. The literature revealed two articles that talked about the specific interventions that occupational therapists employ in order to teach ADL techniques. Both articles (Guidetti & Tham, 2002; Jannings, 2008) revealed personal activities which included: grooming techniques (e.g., brushing hair, brushing teeth, shaving, or even applying makeup); bathing techniques (e.g., washing hair, washing body including lower limbs, or shaving); and, dressing techniques (e.g., undergarments, tops, pants, socks and shoes). However, in the first article, Guidetti and Tham (2002) found that although compensatory techniques tailored to each individual's specific needs were important, it was actually the relationship between the client and the therapist which had the most impact. They found that a trusting relationship developed when the therapists were able to motivate and support clients in setting goals and expectations for therapeutic outcomes. Therapists were then able to employ that trust in encouraging clients to gain experience and build confidence in performing ADL's by modifying and practicing various techniques for their individual abilities.

The second article posited that bowel management programs (e.g., suppository vs. enema) and bladder management programs (e.g., indwelling catheter vs. intermittent catheterization) are also inclusive of ADL functions (Jannings, 2008). Jannings (2008) indicated that for those who choose intermittent catheterization, following a good bladder management program is vital for good renal health. For example, personal care often loses priority with persons who drink excessively. The kidneys produce more urine during alcohol consumption. This will lead to one of two outcomes: incontinence or an excessively filled bladder.

Incontinence is the involuntary leakage of urine. For individuals who are noncompliant with their self-care, this would mean sitting in saturation for long periods of time leading to skin breakdown in the form of decubiti (MSKTC, 2009). On the contrary, when bladders overflow, urine begins to back flow into the kidneys. This can lead to urinary tract infections and kidney infections. If these infections are left untreated, the kidneys will begin to shut down (e.g., kidney failure) and the infection infiltrates into the bloodstream, otherwise known as sepsis, which is potentially fatal (Bombardier, 2003).

In addition, persons with cervical SCI lack fine motor skills. Instead of finger dexterity for grasping, those at the C6 through C8 levels rely on tenodesis or a natural reflex gripping manipulation of the forefinger and thumb (Mangold, Keller, Curt, & Dietz, 2005). This grip is triggered through extension/flexion of the wrist. The better the tenodesis, the easier it may be to perform ADL's.

Other topics covered in occupational therapy may include domestic duties, adaptive equipment, and home or workplace modification information. Domestic duties can include skill sets such as cooking and laundry. Adaptive equipment can include various splints used for activities such as eating, dressing, or leisure. Home modifications can range from changing sink and door fixtures from knobs to wing style handles to installing an access ramp. Workplace modifications can range from raising the height of one's desk for easier access to installing voice recognition software on one's computer (Magee Rehab, 2010; RIC, 2012).

Although each person participates in each therapy category to some extent, every person's rehabilitation plan is highly individualized based on the level and severity of their injury (Magee Rehab, 2010; RIC, 2012; Zanca et al., 2011). It must be noted that no two injuries of the same level will heal in such a manner which would result in the same level of functioning. For

example, one person with a C6 level injury may be able to function fairly independently with self-care (e.g., dressing and grooming) and be able to physically propel a manual wheelchair. On the contrary, another person with a C6 injury may need a great deal of assistance with self-care and may only be able to operate a motorized wheelchair.

Unfortunately, there are people who have decreased stays in rehabilitation institutes for noncompliance or simply because they just dropped out (De Vivo, 2006; Kolakowsky-hayner et al., 2002). It is not surprising then that those who discharge early or are noncompliant would not gain the experience needed to function independently or the knowledge necessary to direct others in their personal care. This could very well lead to isolation, depression, and suicidal ideations (Kishi, Robinson, & Kosier, 2001).

The culmination of the results of all the different therapies combined with each person's own drive, determination, progress, and personal preferences will ultimately determine the subjective definition of independence for each individual. Objectively, the Functional Independence Measure (FIM) is an 18-item assessment tool used to measure the severity of the disability as well as the level of care needed in performing activities of daily living (ADL's) (Dahlberg, Kotila, Kautiainen, & Alaranta, 2003).

Rehabilitation Discharge

Once an individual has reached their maximum functional potential during acute inpatient rehabilitation, they will be discharged from the rehabilitation institute. In a study conducted by Anzai, Young, McCallum, Miller, & Jongbloed (2006), it was found that more often than not, the discharge destination is to the individual's private residence. However, there were several factors must be considered which include SCI level and demographics.

sci level. Anzai et al. (2006) noted that the level of the cervical injury greatly influences discharge destination as the higher level of injury may require around-the-clock skilled care. Persons with spinal cord injuries at the C1-C5 level would be ventilator dependent. A person requiring this level of skilled care is often discharged to a nursing home.

demographics. Anzai et al. (2006) found that demographics also influence discharge location. This includes age, race, employment status at time of injury, education level, and marital status. They indicated other demographics to be considered are functional independence, geographic region, and third party sponsor of rehabilitation.

Geographic region is extremely important as being discharged to an area that is either inaccessible or isolated, could inadvertently place the individual in harm's way. One such example would be an apartment dwelling located on an upper floor which is not equipped with an access elevator. Another critical area of concern is that emergency services may not be available to homes located in remote or inaccessible areas (Anzai et al., 2003).

Third party sponsors include worker's compensation, automobile insurance, or private disability insurance. These types of insurance tend to pay for more services for longer periods of time than government sponsored programs (Anzai et al., 2003).

Secondary Symptoms of SCI

SCI rehabilitation practices introduce numerous compensatory techniques for developing skills critical to maintaining health and function for longevity of life. Once rehabilitation has been completed, whether successful or otherwise, the individual with a SCI is discharged (Anzai et al., 2006). After just six to eight weeks, the individual with SCI is expected to have gained the necessary tools/knowledge to be able to either function independently or direct others in their personal care. Whether at home, at a long-term care facility, or in some other setting, the

individual with a SCI now begins the rest of his or her life with a long-term disability. Despite one's age at the onset of injury, the natural aging process which is degenerative in nature is now coupled with a disability whose secondary symptoms are degenerative in nature (Wiley, 2003).

Pharmaceutical Interventions

Although life expectancy decreases with a SCI, improvements in the medical management of the three leading causes of mortality associated with SCI contribute to increased life expectancy. Those three most common health concerns leading to mortality after SCI are: pneumonia; pulmonary embolism; and septicemia due to pressure sores, other respiratory infections, and urinary tract infections (Wu & Chan, 2007). There are several other secondary conditions and opportunistic infections associated with SCI for which long-term prophylactic pharmacological treatment (e.g., medicine used for preventive measures) is necessary.

autonomic dysreflexia. Both Dunn (2004) and Krassioukov et al. (2007) assert that AD is a condition in which blood pressure, heart rate, and respirations become elevated enough to trigger a seizure or stroke. Due to these systemic elevations, AD often manifests as a “severe pounding headache”, and can be caused by pressure ulcers, urinary tract infections, urinary retention, and respiratory infections among other things. Other symptoms include: diaphoresis of the head, neck, and shoulders; piloerection; cardiac arrhythmias; and, blurred vision (Dunn, 2004; Krassioukov et al., 2007). AD is episodic and can be treated with nitroglycerin and other medications which decrease heart rate and relax blood vessels. However, when AD goes undiagnosed or is misdiagnosed, symptoms can become fatal (Dunn, 2004; Krassioukov, 2007).

spasticity. Spasticity is also common with SCI. This is a permanent condition in which muscles spasm uncontrollably, often violently. This condition can easily be treated with muscle relaxers and anti-spastic medications such as Baclofen and Botox (SpineUniverse, 2009).

neurological pain. Neurological pain is common and treatment is palliative at best. The pain is localized in areas below the level of injury where there is decreased or complete loss of feeling and is often described as a deep burning sensation (Cairns, Adkins, & Scott, 1996; Heutink, Post, Wollaars & Van Asbeck, 2011). Neurological pain can be treated with muscle relaxers, anti-inflammatory medications, antidepressants, and narcotic pain killers as well as anti-seizure medications (Cairns et al., 1996).

It is important to avoid using alcohol when using prescription medications as it can have adverse effects such as stomach and intestinal bleeding, liver damage, confusion, increased drowsiness, decreased motor coordination, and other debilitating conditions including excessive bleeding or developing blood clots (Bombardier, 2003).

Mental Health Issues

Although the physical switch from being an able-bodied person to a person with Tetraplegia is instantaneous, transitioning into that new role can sometimes be a very lengthy and lonely process, not only for the physical changes that must be overcome but for the emotional and psychological changes that occur as well.

depression. Depression can be a disabling condition and is associated with excessive mortality (Elliott & Frank, 1996). It includes such behaviors as anxiety, insomnia or hypersomnia, tension, and fear. Elliot and Frank (1996) posit that when diagnosed early (e.g. while an inpatient in rehabilitation) counseling and pharmaceutical intervention can lessen the debilitating effects of depression.

From a biopsychosocial perspective, individual coping skills, the degree of accessibility of the individual's immediate environment, and having a strong social support system are key elements in adjusting to life with a disability and staving off or minimizing the severity of

depression (Elliott & Frank, 1996). Other factors which seem to influence life satisfaction are: age at onset of SCI; community involvement; and secondary health complications such as chronic neurological pain, spasticity, pressure ulcers, and urinary tract infections (Barker, Kendall, Amsters, & Rimmele, 2009; Cairns et al., 1996; Tonack et al., 2008). Research done by Cairns et al. (1996) suggest that while pain and depression are both related to SCI, chronic pain has the largest direct effect on depression.

suicide. Kishi et al. (2001) report that persons with SCI are 4.9 times more likely to commit suicide than their able-bodied counterparts. They report the following as predisposing, though not causative, symptoms: anxiety, foreboding, morning depression as well as major depression, weight loss, delayed sleep, and subjective anergia (e.g., lack of energy). Added to this list is early morning awakening, loss of libido, worrying, brooding, loss of interest, hopelessness, social withdrawal, self-depreciation, lack of self-confidence, and irritability. Another risk factor for suicide after SCI is pre-injury alcohol consumption (Tate et al., 2004).

Surgical Interventions.

For persons with C6 through C8 Tetraplegia, there are procedures available which serve to increase functional independence thereby improving quality of life. At the very least, body image may improve.

bladder augmentation and catheterizable stoma. This procedure uses a portion of the bowel to connect the bladder to either the umbilicus (e.g., bellybutton or navel) or the abdominal wall enabling the individual to empty the bladder via the umbilicus or stoma as often as necessary (Burns, 2009). This would eliminate the need for an indwelling catheter; a device anchored inside the bladder which has an external urine collection bag usually attached to the wheelchair or the person's lower leg.

tendon transfer. By attaching a working tendon in the upper arm to a non-working tendon in the forearm, partial hand function (e.g., fine motor manipulation) is restored to the thumb, index finger, and middle finger (Goloborod'ko, 2004). Although this procedure does not restore strength, it serves to restore function related to grasping and partial fine motor manipulation. The restoration in grasping could mean the difference in an individual having the ability to perform personal ADL's.

Post-Rehabilitation Outcomes and Life Satisfaction

A study by Schopp et al. (2007) was conducted to look at “perceived choice over life activities and to identify perceived barriers to engaging in life activities.” They used the Participation of People With Mobility Limitations Survey instrument which measures different major life activities. This study assessed four of these life activities which were bladder care, leaving the home, working inside the home, and employment. They hypothesized that a Caucasian person with a SCI who had a higher education and a spouse or significant other would have greater perceived choice and satisfaction with life activities. Results showed a majority of satisfaction over choice in every activity except employment but respondents perceived little to no choice in every activity when compared to persons without disabilities. It appears that a person's perception can be a huge barrier in daily functioning in addition to environmental barriers.

Alcohol and Other Drug Abuse

Regardless of use patterns prior to injury, acquiring a SCI means greater risk of abusing drugs and/or alcohol. It also means greater risk for health complications which increases further with comorbid AODA problems. Data from surveys administered to both clinical and general populations show that AODA problems for persons with traumatically acquired physical

disabilities is approximately 50% or more (West, Graham, & Cifu, 2009). Research indicates that those who had alcohol use problems pre-injury would have significantly increased medical complications post-injury (Bombardier, Stroud, Esselman, & Rimmele, 2004). Those with a history of significant alcohol problems who abstained after SCI experienced greater incidents of urinary tract infections, pressure ulcers, depression, and lower acceptance of disability (Bombardier et al., 2004). Despite a person's level of functional independence, those who drink or use illicit drugs put themselves at risk for noncompliance of both self-care and medication adherence. Bombardier et al. (2004) state that alcohol and drug use post-injury may adversely affect judgment which would also lead to improper bladder management and misuse of common over-the-counter and prescription medications.

Summary

Acquiring a SCI is not the automatic death sentence it once was. However, despite one's level of SCI, there is a great deal of personal responsibility involved in post-hospitalization/post-rehabilitation outcomes if longevity of life is to be achieved.

Educating one's self on their newly acquired SCI and engaging in repetitive practice of the compensatory techniques in performing ADL's appears to be *the* critical elements in setting goals and achieving success (Kishi et al., 2001; Kolakowsky-Hayner et al., 2002). Participating in the many different therapies offered at the model rehabilitation centers is only a first step in educating oneself on not only the SCI itself, but most importantly, how to live with a major disability.

CHAPTER 3

DISCUSSION AND IMPLICATIONS

Despite having knowledge of the effects of SCI's for thousands of years, there were no significant treatments available to stabilize the spine and prevent secondary life-threatening symptoms associated with SCI. Not until the mid-20th century did life expectancy begin to rise. Fast forward to 2012 and we find that within the past sixty to seventy years life expectancy has risen from a mere 18 months post-injury (Fernhall et al., 2008; Kemp et al., 2004), to the current range of 20 to 40+ years post-injury depending on the age at onset of injury (NSCISC, 2011). This growth in life expectancy has lessened the gap between this growing population and that of their able-bodied counterparts.

What this means is that those who acquire a SCI must now learn how to live and function long-term with a major debilitating disability. The first step after acquiring a SCI and undergoing spinal stabilization is admission to a model care inpatient rehabilitation facility where he or she will undergo a barrage of therapies in order to learn compensatory techniques on how to function independently (or at the very least, how to direct others in their personal care). Both PT and OT are intense and exhaustive. With so much information and skills to learn in such a brief timespan, it is critical to one's longevity of life to be compliant with their individual treatment plan.

Something not identified in the literature were the specific compensatory tasks/techniques that are practiced in PT in order to build flexibility and coordination, strength and endurance, balance and core stability, wheelchair management/propulsion, and all forms of transfers as well as performance and management of ADL's. This author sustained a C6 SCI in 2002; based on personal and observed experiences, the following is a description of those tasks:

During PT, flexibility, coordination, balance, and core stability were addressed while doing mat exercises (e.g., exercises done on a padded height-adjustable table) and other activities which include: passive stretching; maintaining a sitting balance by practicing short sitting (e.g., normal sitting position as when in a chair or on the edge of the practice mat) and long sitting (e.g., sitting on the practice mat or in bed with legs extended straight out). Additional exercises include reaching for various items or tossing and catching a lightweight ball or balloon; repositioning self by scooting across the mat surface or rolling from side to side; and, physical propulsion of a manual (e.g., non-motorized) wheelchair. Strength and endurance were addressed by weight training with Therabands as well as with wheelchair accessible weight machines.

Transfers were done with a board placed under the upper thigh used to slide to and from many different surfaces such as: from the bed to the wheelchair and back; from the wheelchair to the practice mat and back; and from the wheelchair to the shower chair or shower bench and back. Car transfers and floor transfers were practiced as well in order to be able to direct others when receiving assistance.

Also during PT, participating in periodic community outings gave the opportunity to learn how to function and maneuver on different surfaces in the outside world prior to discharge. This gave first-hand experience in facing and overcoming environmental barriers in an uncontrolled setting.

Although these tasks may at first glance appear unmanageable for a person with a mid- to low-level cervical SCI, they serve a much larger purpose. Repetition in practicing these activities will not only improve coordination, strength, and core stability, but will also build confidence as each task becomes easier as well as improve critical thinking skills. Critical

thinking skills will prove valuable when faced with overcoming environmental or any other barriers. Upon returning home, one's mastery of these skills will be put to the test as going from a controlled institutional rehabilitation environment to an uncontrolled private residential or even long-term care environment will not be an easy transition. The next step for the individual with a SCI will be to determine what direction his or her life should go based on their level of functional independence and personal preferences.

The concept of functional independence is both tangible and subjective. First, evidence-based literature supports the fact that despite even severe neurological deficits from SCI as high as C6, functional independence is more than a possibility through the mastery of compensatory techniques tailored to each individual's abilities in order to perform ADL's (Sadowsky & McDonald, 2009; Guidetti & Tham, 2002; Jannings, 2008). On the other hand, personal preference along with time management skills will also be factors when performing ADL's or participating in life activities. For example, one person with a C6 SCI may want to perform every task possible despite how long it may take in order to maintain strength and abilities at the expense of time lost that could have been spent engaging in life activities. On the contrary, another person with the same level injury may choose to employ a personal assistant to help with ADL's in order to have the extra time to engage in life activities. Both would be able to participate in those activities, just one more so than the other.

With the expected continued growth of this population each year, a rehabilitation counselor, and any other human service professional, will work with a client who has a SCI of some degree. Having a basic understanding of the process from SCI acquisition to provision of rehabilitation services will prove beneficial when providing services to this population. With regards to the functional independence and personal preferences discussed above, time

management will be an important topic to be aware of. Another crucial step when working with a client from this population, or any population with disabilities, will be to know your own biases as whether you view disabilities through the Moral Model, the Medical Model, or the Social Model. Rehabilitation professionals cannot provide appropriate therapeutic services to this population if they believe the individual is deserving of the disability or lacking in abilities because of it.

Of utmost importance is that for those clients who wish to rejoin the workforce, the rehabilitation professional must consider the topic of secondary symptoms associated with SCI. Questions that must be asked include: “Is the place of employment easily accessible for wheelchair users?” (e.g., entrance ramp and/or automatic doors); “What type of time accommodations can be made for wheelchair users who must do frequent pressure reliefs to avoid developing decubiti?”; “Can space accommodations be made for those who utilize intermittent self-catheterization to empty their bladder?” These issues can be huge barriers in returning to work and can exacerbate secondary complications when not available.

Future In Research

SCI Model Care Systems (Chen et al., 2011) are acute rehabilitation institutes that receive federal funding from the National Institute on Disability and Rehabilitation Research in the U.S. Department of Education for their continuous contributions in SCI research. In addition to providing comprehensive SCI rehabilitation services, Chen et al. (2011) report that these Centers, of which there are currently 21 across the United States, are required to: “(1) contribute research data to the longitudinal portion of the National Spinal Cord Injury Statistical Center’s Database; (2) lead/participate in 1 or more research module (collaborative) projects; (3) conduct individual site-specific research projects that involve their own patient population; and (4)

disseminate scientific findings to professional and consumer audiences” (p. 329). Current research topics include: “development of measures for hand function, functional activities, wheelchair seat cushion degradation; clinical intervention on pain, depression, and respiratory complications; a practice-based evidence study of pressure ulcers; investigation of a low-cost option for intensive treadmill training, the beneficial effects of trunk muscle electric stimulation and telemedicine, and issues related to access to care, vitamin D deficiency, and psychosocial status during the acute stage of injury” (Chen et al., 2011, p. 330).

In terms of neurological functional recovery, current trends involving stem cell research and rats show significantly improved locomotor functional recovery (Dittgen et al., 2012; Shang et al., 2011). Due to ethical conflict surrounding the harvesting of human stem cells, no evidence was found in the literature that would suggest clinical human trials have ever been conducted.

What this means for the future is that researchers are continuously looking for innovative methods to improve the quality and longevity of life for those with SCI. Innovative ideas are taking research in a direction that may one day present an effective treatment for SCI and quite possibly even a cure.

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